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CARNIVOROUS PLANT NEWSLETTER

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Front Cover: *Utricularia janarthanamii*, chasmogamous flower. Photograph by S. Ingalhalikar. Article on page 12.

Back Cover: The Alarm River site for *U. australis* in Lar National Park. Inset: *U. australis* in flower. Photograph by A. Naqinezhad. Article on page 4.

Carnivorous Plant Newsletter is dedicated to spreading knowledge and news related to carnivorous plants. Reader contributions are essential for this mission to be successful. Do not hesitate to contact the editors with information about your plants, conservation projects, field trips, or noteworthy events. Contributors should review the "Instructions to Authors" printed in the March issue of each year. Advertisers should contact the editors. Views expressed in this publication are those of the authors, not the editorial staff.

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<i>Dionaea muscipula</i>	<i>D. peltata</i> subsp. <i>auriculata</i>
<i>Drosera binata</i>	<i>D. tokatensis</i>
<i>D. binata</i> —Coromandel, NZ	<i>Ibicella lutea</i>
<i>D. burmannii</i>	<i>Nepenthes truncata</i>
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<i>D. capensis</i> —narrow leaf	<i>S. oreophila</i>
<i>D. capensis</i> —red	<i>S. purpurea</i> subsp. <i>venosa</i>
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UTRICULARIA (LENTIBULARIACEAE) OF IRAN

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Keywords: Live collections: *Utricularia australis*, *U. minor*, Iran.

Received: 4 April 2007

The distribution of *Utricularia* in Iran is not well known and represents a gap in our understanding of the ranges of some species. In 2006, one of us (A.N.) was botanizing in the northern portions of Iran and made some collections which considerably expand our knowledge. These specimens, which have been stored at the University of California, Davis herbarium (DAV) and Tehran University Herbarium (TUH) are described in the following paper.

The north-central border of Iran is marked by the Caspian Sea, which is met on the Iranian side by the Alborz Mountains. Although only approximately 100 km wide (north to south), this mountain range reaches elevations greater than 4500 m and forms a long, east-west barrier that separates the moist (approximately 1000-2000 mm annual precipitation) Caspian Sea climate from the more arid (280-500 mm annual precipitation) Tehran-Semnan plateau to the south.

Prior to 2004, the only *Utricularia* species known from Iran was *Utricularia australis* R.Br., which is also found in the neighboring Turkey, Iraq, Yemen, Afghanistan, and Pakistan (Schlauer 2000, 2002; Taylor 1989; Casper 1969). *Utricularia vulgaris* L. was reported (Parsa 1949; Shokri *et al.* 2004) in Iran near the Caspian Sea, although this might be an erroneous detection of the very similar *U. australis* (see further discussion of similarities below). The detection of *U. vulgaris* would not, however, be too surprising since it has been reported from the bordering Turkey, Afghanistan, Pakistan, and the nearby Syria (Schlauer 2000, 2002; Taylor 1989; Casper 1969). As yet, the "*U. vulgaris*" collection has not been inspected by either author of this paper. The only other *Utricularia* species reported for this region in the Middle East are *Utricularia minor* L. (Turkey, Afghanistan, and the Republic of Azerbaijan), *U. ochroleuca* Hartm. (Afghanistan), and *U. aurea* Lour. (Pakistan).

Collection #1: *U. australis* R.Br.

The first collection site was at Lar National Park, Tehran Province (E51°58'22.0", N35°55'58.3", 2500 m a.s.l.). The plants grew in small wet and scattered depressions (up to 50 cm deep, pH=7.8) on the edge of Alarm River, in a community dominated by *Juncus inflexus* L. Other plants in the community include *Batrachium trichophyllum* (Chaix) Bosch, *Chara* sp., *Potamogeton pectinatus* L. and *Zannichellia palustris* L. (see Back Cover)

The specimen (#BR060801, DAV) consists of several stolon segments, equivalent to a total stolon length of approximately 110 cm of plant material. The leaves are approximately 2 cm long, and pinnately divided into numerous capillary ultimate segments. Bladders are scattered throughout. The ultimate leaf segments bear lateral and terminal setulae (bristles); the lateral setulae are set upon small teeth on the leaf margins. The stolons are not at all dimorphic (compare with descriptions of plant collections below). Two inflorescences are included in the specimen, with scapes approximately 5-6 cm tall, each bearing 2-3 scales and 3-4 flowers (some of which are mature). Capsule development was not exhibited, nor was it observed in the field.

Based upon the monomorphic stolons, lateral setulae set upon teeth, and presence of inflorescence scales, this plant was easily identified as *U. australis* R.Br. Microscopy of the quadrid glands provided supporting evidence as the arms in the gland long-arm pair were weakly diverging, while

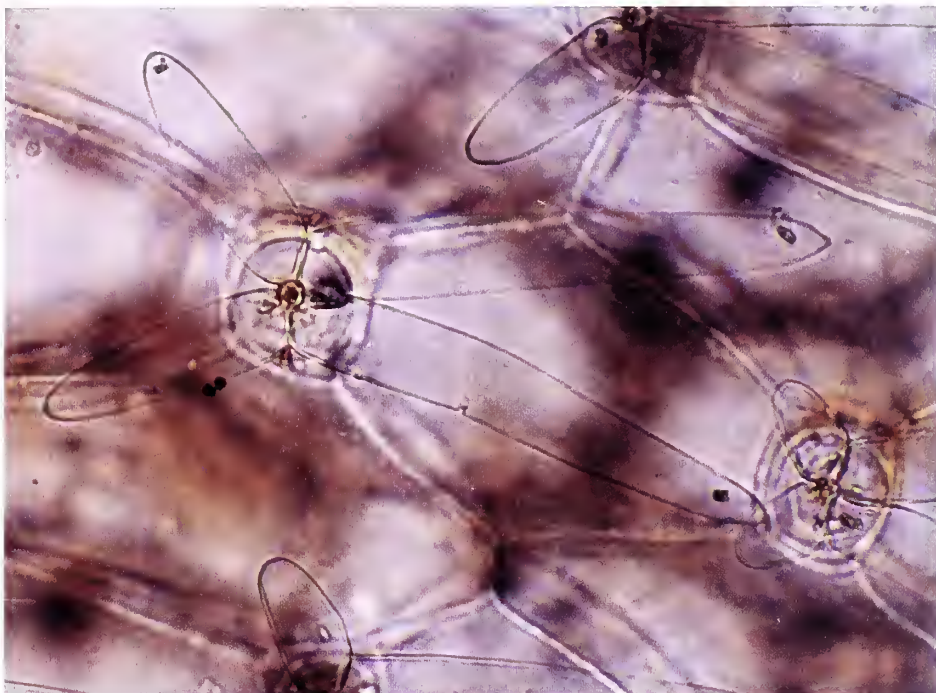


Figure 1: Quadrifid glands of *U. australis* in Lar National Park, 400x. Photograph by A. Naqinezhad.



Figure 2: The Mazandaran Province site for *U. minor*. Photograph by A. Naqinezhad.



Figure 3: *Utricularia minor* from the Mazandaran Province. Photograph by A. Naqinezhad.

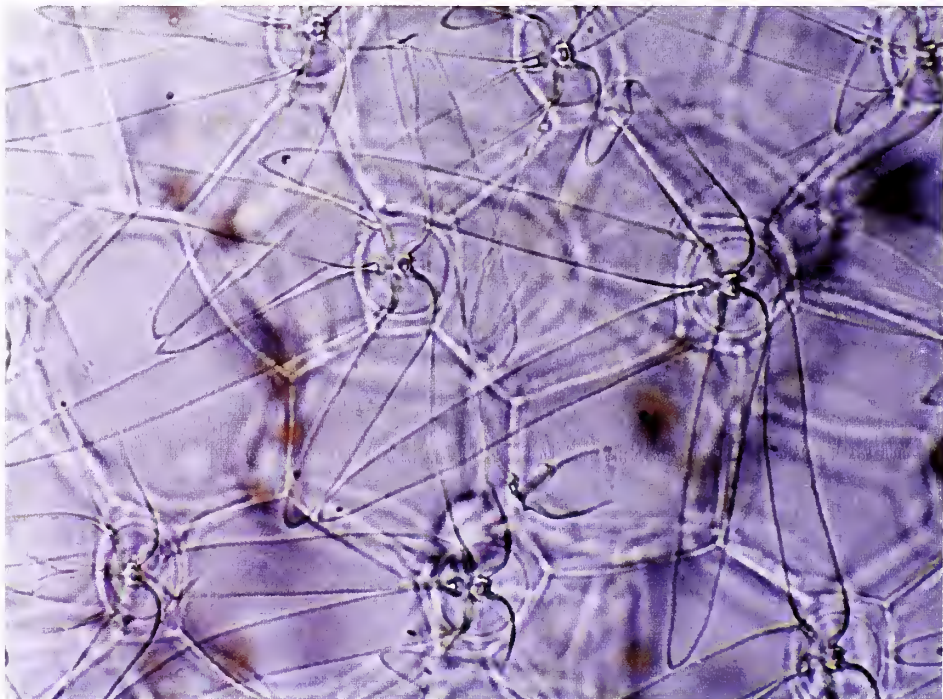


Figure 4: Quadrid glands of *U. minor*, Mazandaran Province, 400x. Photograph by A. Naqinezhad.

the arms in the short-arm pair were highly divergent (see Figure 1). It is easy to confuse *U. australis* with *U. vulgaris*—the most reliable character for vegetative material is to note that the lateral setulae are set directly on the leaf margins for *U. vulgaris*, while they are mounted on small teeth for *U. australis*.

Utricularia australis has been previously reported in northern (Caspian lowland area) and western (Lorestan) parts of Iran (Casper 1969).

Collections #2 and #3: *U. minor* L.

The next collection site was between Tehran and Amol in Haraz road, Yoush-Baladeh deviation, between Razan and Baladeh, Mazandaran Province (E52°1'11.8", N36°12'7.8", 1735 m a.s.l.), approximately 30 km due north of the *U. australis* site. This site was a small pond (approximately 70 m² surface area, pH=7.7) up to 60 cm deep. This pond is associated with riparian habitat along the Baladeh River, one of main branch of Haraz River. The pond shrinks during the end of summer and is completely dry during autumn and winter. *Utricularia minor* was accompanied by *Chara* sp., *Potamogeton lucens* L., *Potamogeton pectinatus*, *Schoenoplectus lacustris* (L.) Palla and *Typha lugdimensis* P. Chabert (see Figure 2).

Although the collection (#BR060501, DAV) consists of approximately 200 cm of stolons in a tangle, the plant is overall smaller and more delicate than the species in the previous collection. Leaves are 0.4-0.8 cm long, variously palmate-dichotomously divided to 6-20 terminal leaflets (see Figure 3). Bladders are scattered throughout, but are more common on some shoots so that there is a weak dimorphism in the nature of the shoots. Under 20× magnification, the terminal leaflets are weakly to moderately flattened. Lateral setulae are absent, apical setulae are absent or occasionally present but minute. A few turions, having sprouted into growth, are present, and its broadly segmented leaves are similarly asetulose. No flowers are present.

Based upon the weakly dimorphic stolons, flattened leaf segments, and absence of lateral setulae, the only likely possibilities are *U. minor* L. and possibly *U. brenii* Heer ex Kölliker. The broadly segmented leaves of the recently sprouted turions are, as Taylor (1989; p11) notes, unique to *U. minor* L. and *U. brenii*. The bladder quadrifid glands were observed under a microscope at 400×. The arms in the long-arm pair are separated by approximately 30°, while the arms in the short-arm pair are separated by approximately 315° degrees, so all four arms are pointing in approximately the same direction (see Figure 4). This is consistent only with the assignment of the specimen to *U. minor*. This is a new species for Iran, and is important because it represents a detection of *U. minor* at a site that bridges previous detections for the species in Turkey and Afghanistan. This record is a new report for the species in the Flora Iranica area. The first report of the species in this area was only from E Afghanistan (Casper 1969); it is also recorded for the Republic of Azerbaijan (Meusel *et al.* 1965).

This species with above-mentioned characters was collected in another wetland site, Sahooon Lake, in the mountains near Arjomand village, Firuzkuh, Tehran Province (E52°20'56.64", N35°50'57.43", 3097 m a.s.l.-Naqinezhad, 36933-TUH), and approximately 35 km east-southeast from the Alarm River *U. australis* site, and 49 km southeast of the Haraz Road *U. minor* site. This lake (approximately 1 ha surface area, pH=7.6, up to 2 m deep) is at a significantly higher elevation than the other collections we are reporting (see Figure 5). *Utricularia minor* was accompanied with *Carex* aff. *divisa* Huds., *Chara* sp., *Hippuris vulgaris* L. and *Potamogeton pusillus* L.

Collection #4: *U. minor* L.

The fourth collection was again of *U. minor*. However, leaf characters (described below) are sufficiently interesting to merit discussing this specimen separately from collections #2 and 3.

The collection site was on Lasem Road, between Sol-e Bon and Arjomand Village, Firuzkuh, Tehran Province (E52°33'54.8", N35°45'55.2", 2100 m a.s.l.), approximately 57 km east-southeast of the *U. australis* site, and 22 km southeast of the Sahooon Lake *U. minor* site. The plants grew in a perennially wet meadow (area approximately 2 ha, pH=7.3), dominated by *Phragmites australis* (Cav.) Stend. (see Figure 6). Other accompanying plants are *Carex divisa* Huds., *Carex orbicularis* Boott, *Chara* sp., *Eleocharis uniglumis* (Link) Schult., *Epipactis palustris* (L.) Crantz, *Juncus artic-*



Figure 5: The Sahoon lake site for *U. minor*. Photograph by A. Naqinezhad.



Figure 6: The Lasem Road site for *U. minor*. Photograph by A. Naqinezhad.

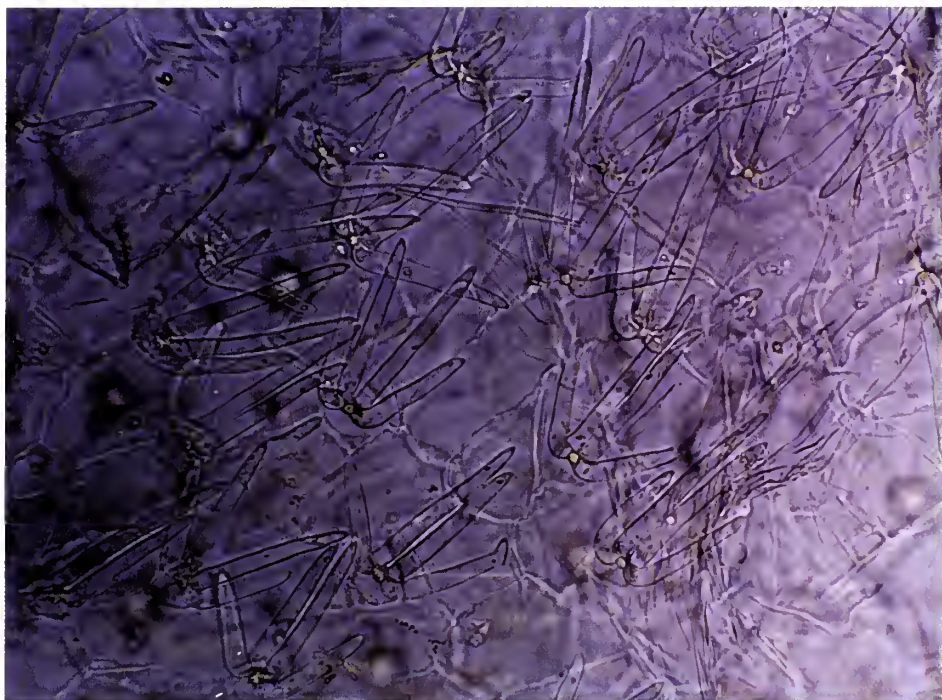


Figure 7: Quadrifid glands of *U. minor*, Lasem Road site, 200x. Photograph by A. Naqinezhad.

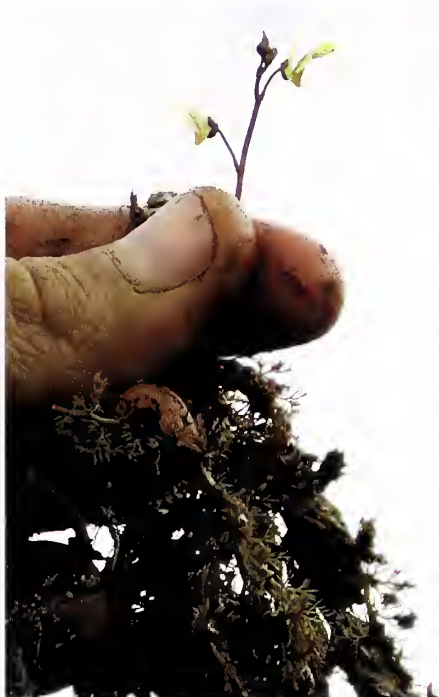


Figure 8: Two views of *U. minor* from the Lasem Road site. Photographs by A. Naqinezhad.

ulatus L., *Lythrum salicaria* L., *Mentha longifolia* (L.) Huds., *Schoenoplectus lacustris* and *Triglochin maritima* L.

The specimen (#BR060802, DAV) consists of a tangled mass of many delicate stolons, each 10-20 cm long. The leaves are 0.15-0.5 cm long, mostly palmately but also dichotomously divided to 8-16 terminal leaflets. Bladders are relatively infrequent, but are present on occasional bladder-rich shoots so there is a weak but clear shoot dimorphism in the specimen. Under 20× magnification, the terminal leaflets are moderately to strongly flattened, with acute tips. Apical setulae are present, as are the occasional lateral setulae. These setulae are uncommon, only 1 (or rarely 2) are present on 25-50% of all ultimate leaf segments, but they are well developed, i.e. the length of each setula is approximately 1/3-1/2 the width of the leaf segment it is mounted upon. The setulae are usually set on small teeth, approximately as long as the setula itself. Three inflorescences are present on the collection, are 10-18 cm long, and bear 5-9 flowers each. The flower is approximately 8 mm long, and yellow.

This specimen is somewhat confusing. The highly flattened leaves, presence of lateral setulae on marginal teeth, and acute leaf tips argued for an identification as *U. ochroleuca* Hartm. However, the number of setulae was somewhat low. Under high power, the quadrifid glands revealed a great surprise as they are entirely and exclusively consistent with *U. minor* (see Figure 7). It was difficult to determine the nature of the flower spur from the pressed specimens, but photographs of them show that the spur is relatively short and confirms the *U. minor* identification (see Figure 8).

In conclusion, this specimen is an interesting case of a variant population of *U. minor* with more flowers per inflorescence than is typical (Taylor (1989) reports 2-6 flowers/inflorescence), and a peculiar presence of apical setulae.

Conservation notes:

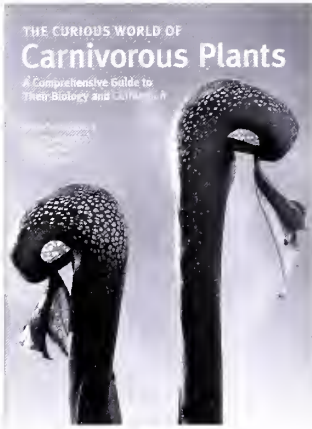
Although all of studied sites belong to Iranian protected areas (Lar National Park and Central Alborz protected area), some of these sites are under threat of human destruction, intensive grazing and degradation. The occurrence of such wetland sites in the steppe habitats of Central Alborz range demonstrates its high level of biodiversity importance. These sites are wet habitats with a patchy distribution over Alborz and therefore must be precisely considered as a refuge habitats of some rare aquatic species such as *Utricularia minor*. The different sites are located in different watersheds (separated by the 5671 m tall Mount Damavand), which offers them a certain amount of protection.

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BOOK REVIEW



Barthlott, W., Porembski, S., Seine, R. & Theisen, I. 2007. *The Curious World of Carnivorous Plants*. Timber Press. 224 pp., text in German, 160 figures, most in color. ISBN-13: 978-0-88192-792-4. \$39.95 + shipping, from Timber Press.

Reviewed by Barry Rice

This book is a translation of a German language version (*Karnivoren: biologie und kultur fleischfressender pflanzen*, 2004) that was previously reviewed by Jan Schlauer (CPN, 2006, 35: 10). However, having been translated to English it is worth reviewing again.

For the most part, this book follows the typical structure that we have come to expect from a general carnivorous plant book. It begins with several introductory chapters on topics concerning carnivory, such as ecology, trapping strategies, digestion, evolution, conservation, and horticulture (all in all, 77 pages). Next follows a chapter by chapter review of carnivorous plants (about 108 pages). Finally, there is a listing of carnivorous plants and end matters such as a list of societies. The photography ranges from good to excellent, and shows some rarely depicted species. Extraordinary SEM images provide novel perspectives as well.

If you already have a few general carnivorous plant books, all this should look familiar. Is it really worth buying another book for your shelves? Yes, I think so, and it is because the authors offer a fresh perspective. Nearly all English-language carnivorous books were written by authors from the USA, England, or Australia; this book brings a new viewpoint, and that makes it different.

For example, this book includes information on inselbergs, a nice review of carnivorous plant biogeography, a somewhat speculative discussion of carnivorous plant evolution, an informative summary on carnivorous plant nutrition, and a detailed description of possibly carnivorous liverworts. These are elements that have been generally overlooked in other books.

Of course, you might not agree with all the opinions in this book. The authors present as fact that *Genlisea* traps only protozoans, although M. Studnicka and F.E. Lloyd have published prior evidence to the contrary. However, I do not present this as a criticism—as I noted earlier, the new perspectives of this book are one of its strengths. And indeed, has any previous carnivorous plant book even attempted to give the reader cultivation advice on how to grow *Triphyophyllum*? This book does!

I also learned, with great interest, that in 1770 Linnaeus pronounced and decreed that the suggestion *Dionaea* was carnivorous was “against the order of nature as willed by God.” According to the authors, this was considered the final word on the topic of carnivory in plants, which took the combined efforts of Joseph Hooker and Charles Darwin to overthrow in 1875. Fascinating, indeed! However, historical events were probably more complicated than this, since the authors note work by William Bartram and Denis Diderot suggesting that not everyone’s suspicions were satisfied by Linnaeus statement.

As for my pronouncement and decree? There is much in this book’s pages to keep you interested!

LOOKING BACK: CPN 25 YEARS AGO

Editor Don Schnell noted seeing a newspaper article concerning: “...a German pharmaceutical company called Carnivora and run by Erwin Machtel and his son Thomas, who claim to have arrested experimental cancers in the cheek pouches of hamsters....A spokesman for the American Cancer Society expressed deep reservations since no scientific literature has yet appeared on this.” Twenty-five years later, and evidence is still lacking that Carnivora does anything other than kill *Dionaea* plants, drain pocketbooks, and give false hope to those suffering illnesses. (BR)

FLORAL DIMORPHISM IN *UTRICULARIA JANARTHANAMII*

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Keywords: observations: *Utricularia janarthanamii*, Field studies: flowering.

The majority of flowering plants produce chasmogamous flowers, which require external agencies like wind, water, or animals for pollination to set fruit. Cleistogamous flowers are reduced flowers that never open and thus show obligate autogamy. Cleistogamous flowers are not uncommon, but chiefly occur in allogamous species, frequently after the conventional allogamous flowers have failed to set seeds. The development of cleistogamous flowers ensures seed is set in the absence of outcrossed seed, but may also produce less-fit offspring. In some plants only cleistogamous flowers are produced, which do not require external agencies for pollination to set fruit. Anderson (1980) reported a bizarre and intriguing way in which these flowers achieve self-fertilization.

Some plants produce both minute cleistogamous flowers and showy chasmogamic flowers on the same plant. Floral dimorphism is well known in many families such as Commelinaceae, Rubiaceae (Maheshwari & Maheshwari 1955), Lentibulariaceae (Taylor 1989) and Malpighiaceae (Koul 2001). Normally chasmogamous and cleistogamous flowers are produced on aerial parts of the plant. However, in some plants chasmogamous flowers are produced above the ground and cleistogamous flowers below the ground (Uphof 1938; Camp & Gilly 1943; Maheshwari 1960). Some members of Malpighiaceae, such as *Aspicarpa*, *Camarea*, *Janusia* and *Gaudichaudia* produce both cleistogamous and chasmogamic flowers on the same individuals, above the ground (Koul 2001). Cleistogamous and/or chasmogamous forms are found in some species of *Utricularia* (Taylor 1989).

The development from biotic to abiotic pollination and further (or directly) to autogamy may be considered as autonomous orthogenesis; but mostly it represents increasing adaptation to adverse conditions. Cleistogamy may either be seasonal, or a phenomenon induced by either inhospitable conditions or by the submersion of a normally emergent inflorescence (or part

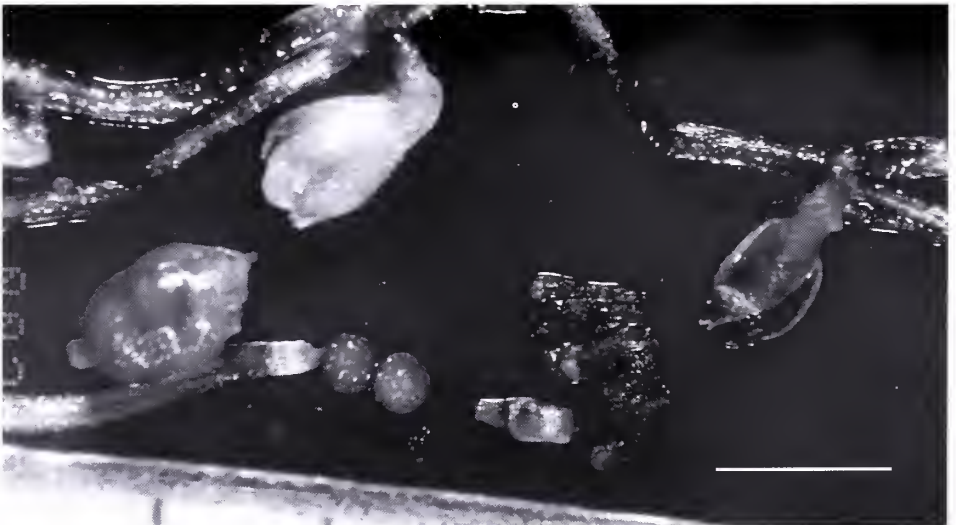


Figure 1: *Utricularia janarthanamii*, cleistogamous flower. Scale bar indicates 1 mm. Photograph by S.R. Yadav.

thereof). In short, chasmogamous flowers are produced in favourable season and cleistogamous flowers in unfavourable conditions. Such conditions may be represented by climates in which biotic vectors do not occur in sufficient numbers to ensure pollination, e.g. too dry or too cool climates.

A number of species produce flowers with a much reduced corolla that are self-pollinated without opening. These flowers are smaller than normal flowers and may be a seasonal phenomenon or induced, either by uncongenial conditions or by submersion of a normally emergent inflorescence or part thereof. Such types are described as pseudocleistogamy or ecological cleistogamy (Uphof 1938). In these species, the cleistogamy is conditional and primarily controlled by the environmental factors. Darwin (1877) and Uphof (1934, 1938) are of the opinion that the cleistogamy is an adaptation for self pollination; these flowers represent retarded forms of chasmogamous type. In certain terrestrial species such as *Utricularia subulata* L., *U. juncea* Vahl, *U. longeciliata* A. DC., *U. minutissima* Vahl, *U. pubescens* Sm. and *U. bisquamata* Schrank, chasmogamous flowers are produced in the favourable season while cleistogamous flowers tend to be produced in the autumn.

However Burck (1906) considered that cleistogamy is controlled genetically and suggested that in many species of angiosperms such a condition might have been originated by mutation. This view is further supported by Weatherwax (1929) and Uphof (1934). In certain aquatic species like *Utricularia benjaminiana* Oliver, *U. breviscapa* Wright ex Griseb., *U. trichophylla* Spruce ex Oliver, *U. dimorphantha* Makino, and *U. hydrocarpa* Vahl, the cleistogamous flowers are at the base of chasmogamic inflorescences (Taylor 1989). However sometimes inflorescences are dimorphic (i.e., chasmogamous as well as cleistogamous), as in *Utricularia geminiscapa* Benj. and *U. trichophylla* Spruce ex Oliver. In these aquatic species cleistogamous inflorescences bear one or very rarely two flowers. Cleistogamous inflorescences are practically without peduncles.

	Chasmogamous flowers	Cleistogamous flowers
Flowers	Racemose, long peduncle	Solitary, reduced peduncle
Bracts	1.4-1.5 mm long	0.25-0.30 mm long
Pedicels	4-8 mm long	Almost absent
Upper calyx lobes	1.8-2 × 1-1.2 mm; 1.9-2.2 × 1.2-1.4 mm in fruit	0.55-0.6 × 0.4-0.5 mm; 0.8-0.9 × 0.6-0.7 mm in fruit
Lower calyx lobes	2-2.2 × 1.2-1.3 mm; 2.5-2.7 × 1.2-1.4 mm in fruit	0.6-0.7 × 0.4-0.45 mm; 0.9-1.1 × 0.5-0.6 mm in fruit
Corolla	Blue to pink	Hyaline
Upper corolla lip	3.2-3.3 × 1-1.1 mm; linear-oblong, crested at centre, rounded or notched at apex	1.2-1.4 × 0.6-0.8 mm; shortly 2-lobed, overlapping lower lip
Lower corolla lip	3-3.2 × 3.8-4.2 mm, obovate, hairy in throat, bigibbous at base, rounded at apex	Shallowly lobed, 1.3-1.5 × 1.5-2 mm, convolute
Spur	2-5 mm long, conical, descending, acute or 2-3 dentate at apex	Almost absent
Stamens	1-1.2 mm long,	0.45-0.5 mm long
Pistil	0.9-1.1 mm long	0.35-0.4 mm long
Capsule	1.8-2 × 1.2-1.3 mm	Capsules: 1.25-1.5 × 0.75-0.8 mm

Table 1: Differences between chasmogamous flowers and cleistogamous flowers of *Utricularia janarthanamii*.

During our survey on flowering plants of Maharashtra State, about 23 species of *Utricularia* were collected (Sardesai *et al.* 2001). On critical analysis, three species turned out to be novelties (Yadav *et al.* 2000, 2005). Of these, *U. janarthanamii* Yadav, Sardesai & Gaikwad exhibits two types of flowers in the same individual. This species grows at an altitude of about 500-600 m on wet grounds, marshy rice fields, and wet grasslands and is known only from the foothills of Western Ghats of Maharashtra. The species flowers from July to April. The rainy season is favourable for vigorous growth. The cleistogamous nature of flowers along with chasmogamous flowers occurs throughout the range of its distribution. The overall dimensions of cleistogamous flowers are much smaller than those of chasmogamous flowers.

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7th Conference of the ICPS in 2008!

It gives me great pleasure to announce that the 2008 International Carnivorous Plant Society Conference will be held in Sydney, Australia. The venue chosen is the Royal Botanic Gardens, in the heart of the city, close to many facilities. Since this is the first time this biennial conference has been held in the Southern Hemisphere it was deemed appropriate for it to be held at a time when the carnivorous plants across most of southern Australia would be at their best, and so the conference will be held from the 25nd to the 28th of September. The conference will include a number of lectures and demonstrations, and there will be some optional field trips to the Blue Mountains and Mt Tomah Botanic Gardens, both within 3 hours drive from Sydney. Provisions are also being made for a field trip to see *Cephalotus*, pygmy sundews and tuberous sundews in South Western Australia for conference attendees able to make it to this part of the country during their stay down under. Stay tuned for further details, and please mark the dates in your diaries; we'd love to see you in Sydney in 2008.

Greg Bourke

REASSESSING COMMENSAL-ENABLED CARNIVORY IN *PROBOSCIDEA* AND *IBICELLA*?

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Keywords: ecology; arthropods, California, *Ibicella lutea*, *Proboscidea parviflora*.

In 1999 I conducted experiments to look for enzymatic activity on the glandular leaves of *Ibicella lutea* (Pedaliaceae), also known as the devil's claw or unicorn plant. I saw no evidence for enzymes, inferred the plants were not carnivorous, and wrote that "These are interesting plants, but I have no room for them in my carnivorous garden. The seeds I will send to the ICPS seed bank will be my last" (Meyers-Rice 1999). Furthermore, on my web site I wrote that "...on the whole, I have lost interest in this non-carnivore" (Rice 2004). Ah, how presumptuous I was.

As the years passed, I started second-guessing my conclusions. Was it possible I was hasty in discounting carnivory in *Ibicella lutea*? Is enzyme production an absolute requirement for carnivory? *Darlingtonia californica* does not produce enzymes—it achieves digestion of captured prey via arthropods and microorganisms that live inside its pitcher. I find it unreasonable to remove *Darlingtonia* from the ranks of carnivorous plants, for it is a highly effective hunter that incorporates both attributes of a pitfall trap and a lobster pot trap (Rice 2007). And if I maintained that *Darlingtonia* was carnivorous, what about the two plants in the genus *Roridula*? These plants capture prey, but like *Darlingtonia*, they achieve digestion through accomplices. In *Roridula*, these accomplices are capsids—bugs in the Miridae family. The capsid species are *Pameridea marlotlii* (for the species that lives on *R. dentata*) and *Pameridea roridulae* (for the species on *R. gorgontias*). These bugs live on the leaves of the plants and consume prey captured on the leaves. Their feces are apparently absorbed through special cracks in the leaf cuticles and thus complete the carnivorous pathway of nutrients from prey to plant (Ellis & Midgley 1996, Anderson 2005). Of course, *Roridula* is not the only sticky plant that provides home for ravenous insects—many field workers such as Robert Gibson, Allen Lowrie, and Siegfried Hartmeyer have documented other Miridae-family insects such as *Setocoris* sp. living on *Drosera* and *Byblis* (Hartmeyer 1998, Lowrie 1998; and others), plants in which carnivory is not questioned.

In mid-2006 I decided to treat the two species of *Roridula* as full-fledged carnivores in my book (Rice 2006) for the reasons outlined above. Shortly after I had finished reviewing the last set of proofs for that book, travel took me to Tucson in southern Arizona. I took some time to look for *Proboscidea parviflora*, a native desert plant so similar to *Ibicella lutea* that the two are often confused. *Proboscidea parviflora* likes disturbed soils, so finding specimens along roads was relatively easy. While studying these plants, I looked for evidence of commensal organisms such as capsid bugs but found none. However, I was impressed by the heavily glandular nature of every above-ground part of the plant (see Figure 1), and the large numbers of tiny bugs captured on the leaves (see Figure 2).

A few months later, back in northern California, I was speaking with two faculty members (Art Shapiro and Tom Lanini) at the University of California, Davis, and they told me of two nearby sites in Yolo county where I could see *Ibicella lutea*. I visited the sites in November 2006. At both locations the plants occurred in weedy areas between agricultural fields. The muddy ground was littered with woody fruit, and gauging by the conditions they were in—they ranged from fresh through tattered to nearly disintegrated—it was clear that *Ibicella* had been growing at the site for many years. *Ibicella* is an annual, and at this time of the year the plants were dying, but there was still plenty of green foliage and ripening fruit on sprawling stems. The largest plants were over a few meters across (see Figure 3). The plants were extremely glandular, and had captured many insects (see Figures 4, 5).

The plants at both sites were being fed upon by larval lepidopterans, an interesting observation because it was the first time insect herbivory of *Ibicella* had ever been documented (Shapiro & Rice 2008). I was particularly fascinated to see two types of insects crawling on the glandular leaves,



Figure 1: Glands on *Proboscidea parviflora* petiole and leaf in Arizona.



Figure 2: Numerous insects trapped on the leaves and petioles of *Proboscidea parviflora*.



Figure 3: Sprawling *Ibicella lutea* plants in northern California.



Figure 4: *Ibicella lutea* inflorescence covered with insect-retaining glands.



Figure 5: A small fly trapped on an *Ibicella lutea* leaf.



Figure 6: Insects observed on *Ibicella lutea*. Left: Juvenile (top) and mature (bottom) capsids, probably *Cyrtopeltis modesta*; right: Berytidae stilt bug.

stems, and flowers without being impeded by the plant's glands (see Figure 6). Specimens of these bugs were identified by staff at the Bohart Museum (Davis), as members of the Berytidae (stilt bug) and Miridae families. The latter species of course is a capsid, and while its species identification is uncertain, it is probably *Cyrtopeltis modestus*. This species is omnivorous, and uses its piercing mouthparts to suck juices from plants but also insects and their eggs. This is one of the species that fulfilled China's (1953) description of a possible evolutionary pathway from a phytophagous capsid to a carnivorous one that might enable commensal-enabled carnivory by a plant.

My interest in the bugs was growing, so I contacted Sigg Hartmeyer; there are few carnivorous plant naturalists who have thought more about capsid bugs than Sigg and his wife Irmgard. Sigg informed me that he had conducted extensive literature searches on the topic of insects that live on sticky plants, and while he had found many papers describing such relationships, none involved *Proboscidea* or *Ibicella* (Hartmeyer, pers. comm., 2006).

So what conclusions can be drawn from these new observations of capsids on *Ibicella*? With *Ibicella* and *Proboscidea* we have two genera of highly glandular plants that trap and kill arthropods. There is no evidence for enzyme production by either set of plants, but for the first time *Ibicella* has been seen hosting carnivorous capsids. This is far from proof that *Ibicella* is carnivorous, but it is suggestive of possibilities. The interactions between *Cyrtopeltis modestus* (?) and *Ibicella* are probably complex, as *C. modestus* is both carnivorous as well as a sap-sucking insect. However, Anderson & Midgley (2007) have noted that *Pameridea* species have similar diets, and apparently become sap-sucking when no prey are available.

A caveat that must be explicitly noted is that these observations were made of escaped plants in California, far outside of the native range of *Ibicella*. However, the Miridae family has a global distribution, and it is likely there are capsids in the native South American range of *Ibicella* that are well-suited to perform a commensal function. But only field observations within the native range of *Ibicella* can prove this. And even if *Ibicella* plants swarm with carnivorous capsids in its native range, do they absorb the fecal nutrients expelled by the capsids? This also must be demonstrated.

So in the final assessment, carnivory in *Ibicella* has not been proven. Perhaps the plant is non-carnivorous, perhaps it is a commensal-enabled carnivore (i.e. a mutualist), or perhaps it is somewhere between. I just don't know! But I think it would be presumptuous to relegate the plant to the "not carnivorous" category just yet.

Acknowledgements: Art Shapiro and Tom Lanini are appreciated for their information on *Ibicella* sites in California. Phil Ward and Lynn Kimsey (Bohart Museum) provided identifications of the bugs I found. No access permits or collection permits were required to complete this study; *Ibicella* specimens were deposited at the herbarium at Davis (DAV).

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LITERATURE REVIEWS

By Doug Darnowski.

Butler, J.L. and Ellison, A. M. 2007. Nitrogen cycling dynamics in the carnivorous northern pitcherplant, *Sarracenia purpurea*. *Functional Ecology* 21: 835-843.

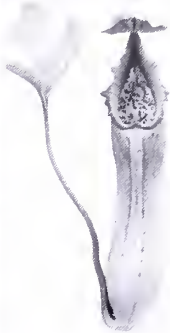
In another excellent paper from Ellison's lab, the reader learns that nitrogen cycling in *S. purpurea* emphasizes pitcher production in the use of nitrogen. ¹⁵N-studies showed that for early-season pitchers, the greatest amount of nitrogen came from the previous year's stores while later leaves used more newly-obtained nitrogen. As has been found in many other carnivorous plants, photosynthetic activity is relatively low for the amount of photosynthetic tissue, and nitrogen possessed by the plant is mostly used for making more pitchers and catching more prey rather than for increasing photosynthetic activity or increasing the amount of photosynthetic tissue. (DWD)

Fritsch, P. W., Almeda, F., Martins, A. B., Cruz, B. C., and Estes, D. 2007. Rediscovery and phylogenetic placement of *Philcoxia minensis* (Plantaginaceae), with a test of carnivory. *Proc. Cal. Acad. Sci.* 58: 447-467.

Perhaps there are yet more carnivores in Brazil? The authors describe their rediscovery of a species in a small and similarly poorly-known and poorly-studied taxonomic tribe, previously known only from one very incomplete herbarium specimen. Of greatest interest to readers here will be the fact that the leaves, emerging through white sand from an underground stem, are covered with glandular hairs which trap a large number of nematode worms. The tests for protease activity used by the authors were good ones, but the humidity levels used and the state of the plants at the time of testing make the negative result highly questionable. The authors plan to continue their work, though propagation of plants has been a major obstacle thus far. (DWD)

Mann, P. 2007. *Drosera gibsonii* (Droseraceae) a new pygmy *Drosera* from south-west Western Australia. *Nuytsia* 16: 321-323.

Phill Mann has named a new species of pygmy sundew, from the Stirling Range National Park in Western Australia, for well-known carnivorous plant expert Dr. Robert Gibson. This species is one of the pygmies with a more elongate leaf blade, closest to *D. silvicola* and reminiscent of *D. scorpioides* and *D. roseana* in leaf form. The points of distinction from *D. silvicola* are shorter scapes with fewer flowers/scape, mauve (vs. red) styles, whiter and more club-shaped stigmas, yellow pollen, sepal apex not pointed, petal color more mauve, erect fruit, and non-persistent scapes. (DWD)



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NAMES OF CULTIVARS REGISTERED IN 2007

Cephalotus 'Eden Black', S.Morley, Carniv.Pl.Soc.J.(UK) 29:7 (2007), 29 Jul.
Sarracenia 'Night', Cahill, Carniv.Pl.Newslett. 36:55 (2007), 30 Jul.
Sarracenia 'Suspicion', Selwyn, Carniv.Pl.Newslett. 36:53 (2007), 30 Jul.
Dionaea 'Petite Dragon', R.Ziemer, Carniv.Pl.Newslett. 36:53 (2007), 30 Jul.
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Nepenthes 'Lady Pauline', R.Cantley, Carniv.Pl.Newslett. 36:68 (2007), 15 Oct.
Sarracenia 'Juthatip Soper', M.Soper, The Garden (UK) 837 (1998), 6 Nov.
Utricularia 'Pittier Moon', T.H.Wyman & G.Hoogenstrijd, Carniv.Pl.Newslett. 36:118 (2007), 24 Dec.

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NEW CULTIVARS

Keywords: cultivar: *Dionaea* 'Microdents', *Drosera* 'Ivan's Paddle', *Pinguicula* 'Down Under'.

Pinguicula 'Down Under'

Submitted: 6 April 2007

This hybrid was created by me in 2001, by crossing a red-leafed clone of *Pinguicula emarginata* and *Pinguicula moctezumae*. The plant that I selected from the progeny is homophyllous, although its carnivory is minimal during winter. About two years ago I decided to name this plant "Down Under" in gratitude to my adoptive country Australia.

Under good conditions the plant has between 10-12 leaves when in active growth. Its leaves are narrowly linear, up to 1 cm wide and 6 cm long (see Figure 1). They are green-purplish but are dark purple at the base. This leaf colour is present even in a shady situation but the purple colour intensifies in sunnier positions. The outstanding leaf color is a major reason I believe cultivar registration is warranted for this clone.

Flowers are uniformly pale mauve and unscented (see Figure 2). The five petals are about 1 cm long. The upper petals are about 8 mm wide and 8 mm long (measured from the petal tip to the point of fusion between them). The two lower lateral petals are 6 mm wide and 10 mm long from the tip of the petals to the point where they fuse with the lower central petal. The lower central petal is about 8 mm wide and approximately 12 mm long, measured from its tip to its points of fusion with the lower lateral petals. All the petals are square-tipped and reticulated with darker veins.

The corolla has a cream to yellowish ring extending from the lower part of the corolla up to the apron-like dark purple lobe of the stigma. This ring does not continue above the stigmatic lobe. The spur is 20 mm long, angled approximately 12° to the pedicel.

The main flowering time is from early spring to early winter, but flowering can occur throughout the year. Each plant may have as many as three flowers blooming at the same time, and they last up to three weeks.

Like both of its parents, *Pinguicula* 'Down Under' responds well to permanently moist to wet conditions. Propagation is readily achieved by vegetative means.

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Drosera × *obovata* 'Ivan's Paddle'

Submitted: 24 July 2007

The paddle-leaved sundew (*Drosera* × *obovata*)¹, as author Adrian Slack calls it, is quite a familiar plant. It gets its name from leaves which are the shape of old-fashioned canoe paddles. The common natural hybrid is ever present wherever the two parent species, *D. anglica* and *D. rotundifolia*, are found growing together. Its great range extends throughout the boreal region encircling the Earth in the northern latitudes. This range also extends into temperate latitudes as in northern California where I first encountered it. Slack describes this sundew as "surpassing the English sundew (*D. anglica*) in size and magnificence". I was smitten. This new unique cultivar of the

¹Note that Art.H.4.1 of the International Code of Botanical Nomenclature requires that the first legitimate name that refers to a taxon of hybrid origin must equally be applied to all subsequent filial generations, back-crosses and combinations of these if all parent taxa are known or can be postulated. So if it is assumed that *Drosera anglica* is derived from a hybrid involving *D. rotundifolia* as a parent species, then the only legitimate name of the back cross *Drosera anglica* × *D. rotundifolia* would also be *Drosera anglica*, and *Drosera* × *obovata* would be a synonym of *Drosera anglica*. —ed. (Jan Schlauer)

hybrid was originally created by cross pollination in July of 2001.

The cultivar name needs explanation. In the past I would label my pots with the common names such as round-leaved sundew or paddle-leaved sundew, for those less technically oriented. People at our local Los Angeles Carnivorous Plant Society (LACPS) meetings getting a specimen of this hybrid clone from me relabeled it "Ivan's paddle-leaf." This became streamlined to Ivan's paddle (see Figure 3). Now, I do like the name, but an embarrassing glitch dawned on me only after the plant had gone around the world and the name was stuck: One day at an LACPS meeting a woman leaning over a bunch of potted plants on the table exclaimed, "I'd like a little paddle". The rest, as they say, is history...

This new cultivar is a manmade selection that differs in two ways from the typical hybrid found in nature. Firstly, this selection is a tropical grower which makes it most suitable for cultivation. The *D. anglica* parent was a tropical form I previously selected from crossing the tropical Hawaiian strain with a larger temperate one from northern California. Although beautiful, the typical *D. × obovata* invariably disappoints growers because of its winter dormancy requirement. Secondly, this *D. × obovata* differs in being fertile.

The fertility issue is elaborated in an article I wrote in 2003 (Snyder 2003). *Drosera × obovata* is of particular scientific interest as it was the first ever cytologically examined plant hybrid (Rosenberg 1909). Typically the hybrid is a sterile triploid ($2n = 30$). In addition, experts including author Donald Schnell have written that all North America sundew hybrids are sterile (Schnell 2002). In creating this new tetraploid form I showed that a fertile *D. × obovata* is possible. Thus, this was an important scientific discovery. I created the cultivar by first doubling the chromosome number of the *D. rotundifolia* parent using the chemical colchicine and then crossed it with *D. anglica*. This way the cells of both plants then had an equal number of chromosomes ($2n = 40$) to more compatibly pair with. This could happen naturally as well although it would be an extremely rare occurrence. As yet no one has reported such a plant in nature.

Some people seem to enjoy the cultivar solely for its name... Although for the more serious carnivorous plant enthusiast it will be a real treat to now be able to enjoy growing this fascinating sundew indoors where it does especially well under artificial lighting. Care for it as you would any temperate sundew, but without the dormancy period. Plant it in long fiber *Sphagnum* moss kept standing in water. I have grown it several years under lights all year long and have never seen it go dormant. However, people growing it outdoors have told me it made a winter bud for them.

The plant is easily propagated by leaf cuttings and division of the clumps it forms over time. Although able to produce at least a few good seed it should not be reproduced this way. Because of its strange hybrid nature it does not breed true. Growing the plant from seed should only be done by a grower wishing to develop new forms. This can be interesting and produce some odd leaf shapes, but many seedlings must be raised as most will be less vigorous. If the seedlings you may produce are worth cultivar status, perhaps you will want to name it 'Your-Name-Here Paddle.' I continue to select progeny in hopes of increasing its fertility and genetic stability, although I am very pleased with one particular second generation clone.

Thanks to everyone for encouraging me to register the name 'Ivan's Paddle'. And remember when you are out on a bog fieldtrip to keep an eye out for that theoretical naturally occurring extremely rare sundew—the fertile *D. × obovata*. And above all, please don't forget to explain to everyone that 'Ivan's Paddle' refers to canoe paddle!

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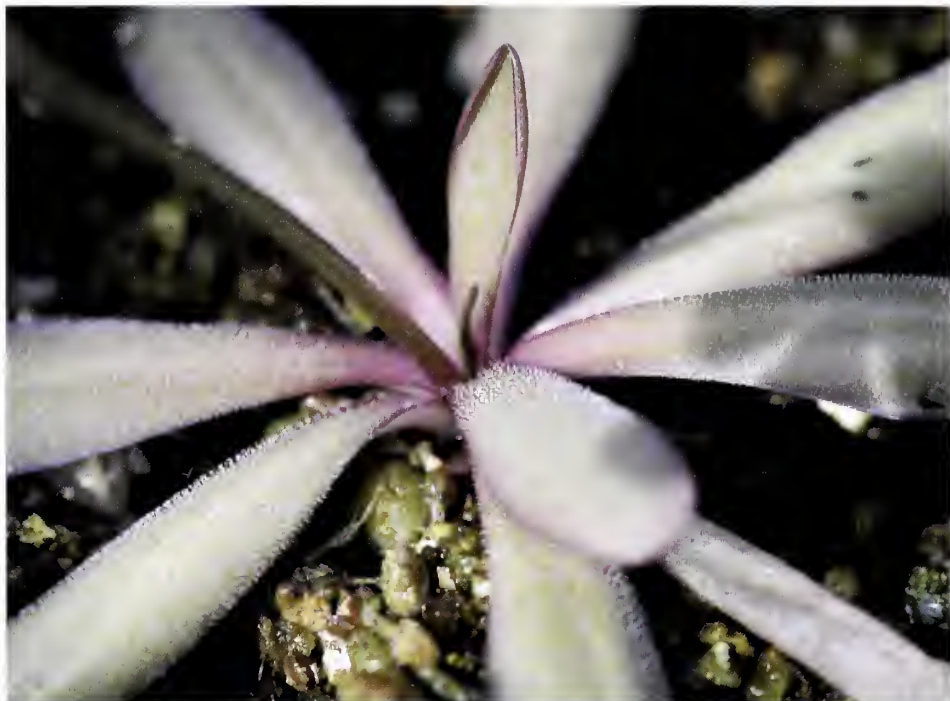


Figure 1: *Pinguicula* 'Down Under' leaf rosette.

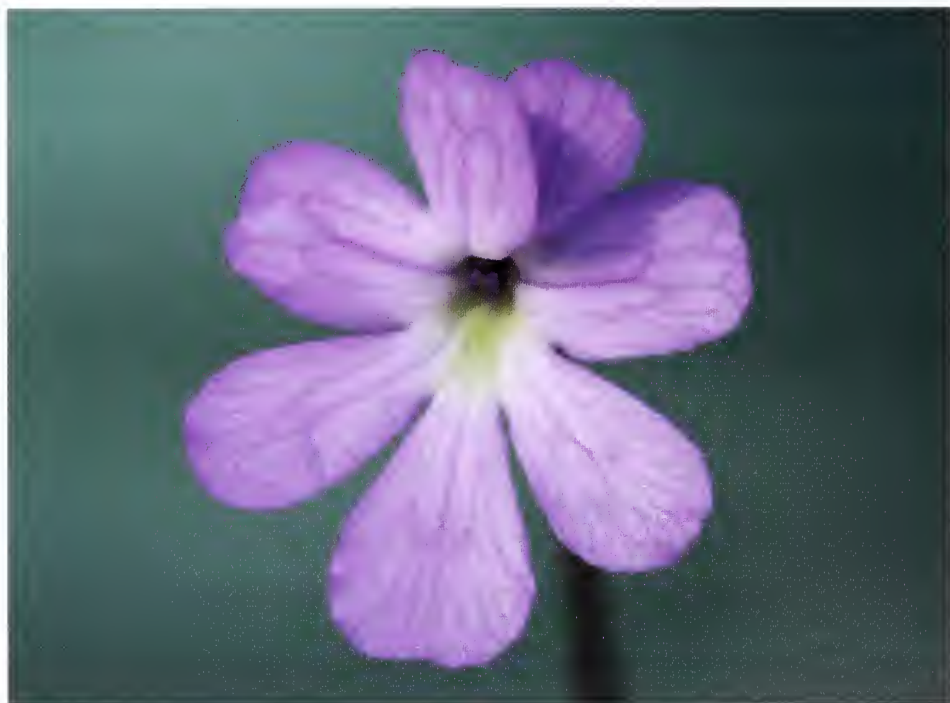


Figure 2: *Pinguicula* 'Down Under' in flower. This atypical flower has seven petals, usually the flowers only have five petals.



Figure 3: The new cultivar *Drosera* 'Ivan's Paddle'. Photograph by Chris Hind, grown by Forbes Conrad. See article on page 22.



Figure 4: The new cultivar *Dionaea muscipula* 'Microdents'. Main photograph by Gayl Quenon. Inset photograph by Bily Guillaume.

Keywords: cultivar: *Dionaea muscipula* 'Microdents'.

Dionaea muscipula 'Microdents'

Submitted: 31 July 2007

On 28 March 2004 this plant was given its cultivar name by Guillaume Bily. The name notes that the marginal teeth on the traps are smaller than normal, and in fact smaller than any other *Dionaea* cultivar in the Dentate Traps cultivar group (see Figure 4). There than be over 80 teeth in a single trap. The lobes of the tap are orange red.

This plant is in the Dentate Traps cultivar group. *Dionaea muscipula* 'Microdents' is sometimes referred to as "microteeth" or "microdentata", but these names are not the official cultivar name. The exact spelling of the cultivar epithet is actually French, and was chosen because the plant was selected in France.

The plant should be reproduced vegetatively to maintain its unique characters.

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A *SARRACENIA PURPUREA* POPULATION IN A PEATLAND OF SOUTHERN NEW HAMPSHIRE

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*To him who works and seeks in her, Science gives much pleasure—to him who learns her facts,
very little... a higher culture must give man a double brain, two brain-chambers, so to speak, one
to feel science and the other to feel nonscience, which can lie side by side, without confusion,
divisible, exclusive; this is a necessity of health.*

-Friedrich Nietzsche, Human, All Too Human

Introduction

This paper presents some summary comments on a previously uninvestigated *Sarracenia purpurea* population of 134 plants. While these data are “old”, from studies I undertook in 1999 as part of a New England College Peatland Research Project, the information has not before been published.

Instead of publishing the information as a rigorous scientific review, I want to provide the reader of Carnivorous Plant Newsletter a qualitative taste of the work I did. The interested reader is encouraged to dig into the details of my data and a portfolio of about thirty images documenting the site, by visiting my web site: <http://sarracenia.mlsuds.com>. My research included observations of the plants and the inquiline community, and how they were affected by the changing seasons. A supplemental paper, also available online, explores the beginnings of an investigation into resource parasitism by Linyphiid spiders in response to morphological correlates of prey capture rates in pitchers of this population of *S. purpurea*.

The population of plants inhabits a small peatland consisting of a floating sphagnum mat (dominated by *Sphagnum magellanicum*) surrounded by a small moat. Preliminary hydrogeological investigations indicate that this site is an oligotrophic, level, quaking peatland. Indicator species of both fen and bog compositions are present so it might be said that this peatland is a poor fen (but for those who enjoy the colloquial term bog, this site can then be called bog-like). There is no open water, although in some areas of the peatland the moat can extend considerably onto the mat causing seasonally fluctuating standing water. The sphagnum mat is dominated by Ericaceous plants (*Kalmia polifolia*, *K. angustifolia*, *Andromeda glaucophylla*, *Chamaedaphne calyculata*, *Vaccinium macrocarpon*) with occasional eastern white pine (*Pinus strobus*), tawny cotton grass (*Eriophorum virginicum*), and sparsely distributed sedges (*Carex* spp.). Ericaceous cover is highly variable throughout the site; some parts of the mat consist of a considerable ericaceous root system, while other spots consist of only *Sphagnum*. The *Sarracenia* inhabit about 1/3 the area of the quaking mat, and are distributed in patches.

Monitoring

For over a year leading up to this monitoring, I spearheaded a research endeavor to explore the biological and environmental systems present at his bog. Starting on 17 May 1999, I made daily visits to the site until 10 June. I first tagged 83 *Sarracenia* colonies (or clumps) with numbered aluminum dog tags. The colonies were marked with a bamboo pole 50 cm high, with a bit of pink flagging attached at the top. Some characteristics I measured are described below. Again, I encourage interested researchers to review the data and tables online.

1) Number of plants per clump. Because it is difficult to determine the number of plants based on pitcher number and orientation, several methods were used to determine number of plants per tag. Some colonies were explored by gently moving sphagnum out of the way and observing or feeling



Figure 1: *Sarracenia purpurea* flowering in New Hampshire.

for root apices. At colonies with more than one inflorescence (both present year's and last year's), the number of inflorescences was used as an indication of number of plants.

2) Number of pitchers per clump. This was counted and a determination was made on the number of actively trapping pitchers. Those pitchers that were filled with water to about half the pitcher volume were counted as actively trapping pitchers. The remaining pitchers were either chewed upon, drained of water, buried in the sphagnum, or moribund. Although the title "actively trapping pitchers" suggests that the plant is producing nectar and/or utilizing prey nutrients, the term is used here primarily to distinguish healthy pitchers from dead or dying pitchers and possibly to determine age of pitchers.

3) Inflorescence characters. Traits such as inflorescence height, bud production, flower orientation (i.e. nodding vs. upright), and other developmental stages were noted over the season (see Figure 1).

4) Pitcher growth. I noted new pitchers as they developed. I made my observations being as non-invasive as possible, so the plants would not be disturbed by my monitoring work. I also documented the production of abnormal flat leaves, which do not function as pitchers.

5) The entire population was mapped, and location-specific data pH and temperature data were collected.

Because of the extensive effort in identifying each plant by tag, plant specific data collection, and mapping the exact location of each plant/tag, any subsequent visits and studies will provide great insight into the developmental changes to this *S. purpurea* population.

Anecdotal Observations

I have included some of those words from my field notebook that offer description in a way no data can. The following words are as scribbled in my pad, with only minor editing for clarity and brevity. Some of the following passages/notes describe the flora and fauna contained in the above sections and the work associated with producing these data; some do nothing but describe. I expect that those who have worked on field projects will recognize the spirit of many of these thoughts and observations, while those who have not experienced the mixed pleasures and frustrations of field-work will gain some insight into this difficult kind of work. More of my comments are visible at my web site.

17 May/99 9:30

-Ahhhhh...! The weather's fine for my 1st day at this project....Now I begin the field work. I expected to find, and still do expect to find, great distances between the earlier paper submitted & what will go on in the field....Today I visited each plant with a tag (almost all). They don't look so good. There are many pitchers that appear to have been chewed upon, both the hood and holes in the pitcher. Many pitchers are entirely dead (moribund/brown) and many contain no water. 1st year (new) pitchers are just beginning to show form.... The inflorescence buds are noticeable as ca. 1.5cm balls extending maybe 2-3 inches from the base. Several plants have inf. buds at their base but the buds have been removed. I need to study growth stages and the development of the plant's anatomy.

20 May/99 9:30

-I've renumbered the plants so that I can produce a more logical map. I still have several plants to tag and still others to flag. All data and plant # will be coordinated when all tagging, flagging, locating and switching is finished. I noticed an incredible # of Bowl & Doily (Ed.—spiders from genus *Neriene*) webs in the top/end of Ericaceous branches. Most of the B&Ds were occupied by 2 spiders. They were all over near pitcher plant #14 area.

25 May/99 900

-Beautiful *Cypripedium* (pink) on "trail" around SE corner toward perch; forest area!

-I've noticed that many of the inflorescence buds are either removed from the plant entirely or moribund. Many of the buds are found sitting on the sphagnum as though they were carefully removed from the peduncle. Many of the peduncles are seemingly wilted or broken at a joint/bend. So far, all of the buds/inf. found removed from the plant are ca. 1.0-1.5-2.0 cm across.

- The flower buds are variable in size. Plant #9 seems to have the largest flowering buds at this time. Some are still only several cm. extended above the root apex while some are >10cm.

27 May/99 900

-I noticed many *Wyeomia* adults in several pitchers. They appeared dead on the surface of the water or flailing about on surface.

-On a pitcher at plant #34 I witnessed a nice visit by a housefly. It landed on the top of the hood and proceeded to explore the pitcher. It traveled down on to zone 1 and methodically traversed the zone. It explored the entire zone tracing several paths. It teetered on the boundary between zones 1 & 2. I waited for it to lose its grip on zone 2 & slip into the water, which was ca. 1cm below zone. It didn't! It made its way onto the nectar roll & explored the surface. I could see its proboscis moving erratically over the surface of the pitcher. It repeated this venture, not in any pattern though, for ca. 5 minutes until a beetle (same as collected on 25 May/99) landed/crawled onto zone 1. The fly then flew to another pitcher on plant #33. I thought I'd witness a trap/capture!...

-new growth is variable in size from plant to plant. Could it be related to microhabitat?!?!

-more dead inflorescences

3 Jun/99 830

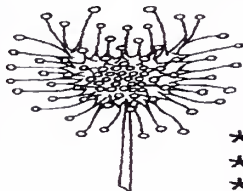
It's likely to rain today. I feel comfortable in the bog when it's raining. Last time it rained while I was there, I climbed up a fallen pine that was resting on limbs from upright pines/oaks. It made for a nice slanted platform to make my way up toward the higher "ground." Once I had climbed ca. 15 feet above the sphagnum mat, I reclined on the fallen tree trunk and rested there for maybe half an hour. Today, this morning, was beautiful. The sky opened up & sunshine made its presence. It was hot but was much welcomed! It was humid, it was hot, the mosquitoes & flies & spiders were out in full force, the mat was close to saturated. . .that's how i like in the bog - Alive!!!

8 Jun/99

-Sitting over pitcher plant #5, I could witness many visits to the pitcher by Culicids. These are presumably the same sp. as the one collected on 7 Jun/99. These small creatures hover in & out of pitcher openings. Some I've seen land & remain still on zone 1 & others, those brave souls, actually wander to zone 2 & 3 if the water level permits. I have spent much time witnessing these visits; not once have I seen a "trap" although I observe dead ones all the time floating on the surface of its grave. Is *Kalmia angustifolia* flowering early?

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